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Range extension of Redside Barb, *Puntius bimaculatus* (Bleeker, 1863) (Cypriniformes, Cyprinidae), from the Nallamalla and Sheshachalam Hill Ranges of the Eastern Ghats, India

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Abstract
We report new distribution records of Redside Barb (*Puntius bimaculatus*), a species of freshwater fish, for the first time from the Nallamala Hill Ranges of Nagarkurnool and Nalgonda districts (Telangana state), and the Seshachalam Hills in Kadapa district (Andhra Pradesh). We provide a brief description of earlier reports and a detailed description of this species.

Keywords
Freshwater fish, Kadapa, Krishna River, Nagarkurnool, Nalgonda, Pennar River.

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Introduction

Freshwater fishes of the genus *Puntius* Hamilton-Buchanan, 1822 are abundant and exhibit a high degree of variability in their morphology (Jayaram 1991, Talwar and Jhingran 1991). The genus consists of about 75 species of small to medium-sized barbs found in stagnant pools to fast-flowing streams of the Indian subcontinent (Jayaram 2010). The species of *Puntius* have been placed into 10 groups based on their geographical distribution and 14 complexes based on their external characters and color patterns (Jayaram 1991, 2010). Species of *Puntius* occurring in India and Sri Lanka show different color patterns and exhibit variability in their characters. *Puntius bimaculatus* (Bleeker, 1863) is one of such species, commonly known as Redside Barb. It is distributed in Sri Lanka and southern India. It was originally described as *Gnathopogon bimaculatus* by Bleeker (1863) based on specimens from Sri Lanka, and as the type locality is not known with precision, it is attributed as only "Sri Lanka". One species, *Puntius puckelli* Day, 1868, which was described from Bangalore and earlier treated as a synonym of *Puntius dorsalis* Jerdon, 1849, vide Hora 1936, was treated by Menon and Devi (1992) as a synonym of *P. bimaculatus*. *Puntius bimaculatus* has been reported from Sri Lanka, and river basins in the Western Ghats in Kerala, Karnataka, Tamil Nadu, and Maharashtra (Pethiyagoda 1991, Jayaram 1991, Arunachalam 2000, Devi et al. 2005, Raghavan et al. 2008, Johnson and Arunachalam 2009, Pethiyagoda et al. 2012). There are occasional sightings and collections of this species outside the Western Ghats, including 1 in the Yercaud

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Figure 1. *Puntius bimaculatus* (Redside Barb) in life.

sub-basin (Arunachalam et al. 2000a, Ramanujam 2015), 1 in the Cauvery river basin in Tamil Nadu (Jayaram et al. 1982), and another in the Gundlakama river sub-basin in Andhra Pradesh (Sharma and Nayak 2006). Fewer scientific records are available for the *P. bimaculatus* in the Eastern Ghats as compared to the Western Ghats (Dahanukar et al. 2004). Hence, we aim to fill this lacuna regarding the occurrence of *P. bimaculatus* in the Eastern Ghats. We report the first records of *P. bimaculatus* in the Krishna river basin of Telangana state, and the Pennar river basin in the Eastern Ghats of India.

Methods

We conducted a random sampling survey of the fish diversity in the Nallamala Hills in Nagarkurnool and Nalgonda districts in Telangana, and Seshachalam Hills in Kadapa district, Andhra Pradesh, India (study and collection permit Rc. No.10873/2015/WL-2, dated.16.09.2015). We collected fishes using cast-nets. We also obtained fishes from local tribes, who used traditional fish traps. Collected specimens were labelled and fixed in 7% formalin (Jayaram 2010). We recorded the coordinates of the locations using a Garmin GPS (model GPS 72H, accuracy ±15 m). The fishes were identified following Jayaram (1991, 2010), Raghavan and Ali (2013), Ramanujam (2015), and Froese and Pauly (2018). Morphometric measurements, to the nearest 0.1 mm, were taken using Mitutoyo digital calipers following Jayaram (2010) and Armbruster (2012). Morphometric measurements such as total length, standard length and head length are presented in mm, while others are expressed as a percentage of either standard length or head length. Voucher specimens are deposited in the Natural History Museum, Department of Zoology, University College of Science, Osmania University, Hyderabad, Telangana state, India.

Results

***Puntius bimaculatus* (Bleeker, 1863)**
Figure 1

New records. India. **Telangana state.** Nalgonda district: stream near Rekulagadda village (16°30.225′N, 079°02.835′E; alt. 370 m a.s.l.), collector: Kante Krishna Prasad, 20-09-2015 (2 specimens: NHM.OU.F-K.21-2015, NHM.OU.F-K.22-2015). Nalgonda district: stream near Devaracharla Village (16°30.525′N, 079°02.342′E; alt. 370 m a.s.l.), collector: Kante Krishna Prasad, 20-09-2015 (2 specimens: NHM.OU.F-K.23-2015, NHM.OU.F-K.24-2015). Nagarkurnool district: Krishna River near Pathalaganga, Eagalapenta (16°05′53″N, 78°54′28″E; alt. 170 m a.s.l.), collector: Kante Krishna Prasad, 21-09-2015 (1 specimen: NHM.OU.F-K.25-2015). **Andhra Pradesh.** Kadapa district: stream near Yerraguntla Kota (13°57′10″N, 079°17′21″E; alt. 220 m a.s.l.), collector: Kante Krishna Prasad, 16-11-2017 (4 specimens: NHM.OU.F-P.01-2017 to NHM.OU.F-P.04-2017).

Identification. *Puntius bimaculatus* can be distinguished from other species of *Puntius* primarily in its convex dorsal profile; small subterminal mouth with thick lower lip; 1 pair maxillary barbels; dorsal fin inserted nearer to the tip of the snout; last unbranched dorsal ray weak, articulated; dorsal fin base greater than least depth of caudal peduncle; presence of a black spot at base of third to eighth branched rays of the dorsal fin; lateral line complete; presence of a prominent black spot on caudal peduncle located on 23rd to 24th lateral line scales; predorsal scales 8 to 10; scales between lateral line and dorsal fin base 3½; lateral line and pelvic fin base 2½; pectoral fins do not extend to the origin of pelvic fins; pelvic fins not reaching anal fins; anal fin not reaching base of the caudal fin. Detailed morphometric measurements, ratios, and meristic counts are provided in Table 1.

Table 1. Morphometric characters (in mm) and meristic counts of the *P. bimaculatus* from the Krishna and Pennar River basins, India. Morphometric characters of from 4–22 are percentage of standard length of the fish and 23–27 are percentage of the head length of the fish.

Morphometric character	Krishna river Basin (*n* = 5)		Pennar river basin (*n* = 4)	
	Average (SD)	Range	Average (SD)	Range
TL—total length (mm)	45.40 (4.1)	39.79–49.96	50.30 (4.57)	46.18–56.65
SL—standard length (mm)	36.00 (3.16)	31.74–39.38	39.30 (3.68)	36.19–44.32
HL—head length (mm)	9.58 (1.14)	7.93–10.93	10.60 (1.30)	9.20–12.32
% SL				
Body depth	25.30 (0.75)	24.61–26.47	27.20 (1.11)	25.92–28.63
Head length	26.50 (1.22)	24.98–27.76	26.90 (1.09)	25.42–27.80
Head depth	17.30 (0.37)	16.76–17.77	18.60 (0.26)	18.30–18.91
Head width	15.30 (0.88)	13.96–16.24	14.70 (1.02)	13.96–16.20
Eye diameter	7.80 (0.42)	7.32–8.32	8.60 (0.54)	7.79–8.94
Snout length	5.80 (0.37)	5.32–6.30	6.50 (0.52)	5.80–6.95
Inter orbital width	9.80 (0.82)	8.70–10.80	9.50 (0.31)	9.21–9.91
Dorsal fin base length or dorsal fin width	13.80 (1.39)	12.22–15.26	12.70 (0.96)	11.50–13.67
Pre-dorsal distance	48.90 (0.48)	48.08–49.30	47.20 (0.95)	45.86–47.89
Dorsal fin length	25.30 (1.27)	23.29–26.56	23.60 (0.48)	22.97–24.10
Dorsal fin origin to hypural distance	52.10 (2.20)	49.48–54.27	54.10 (0.75)	53.45–55.04
Pectoral fin length	19.60 (1.13)	18.25–20.57	20.00 (0.61)	19.49–20.78
Pelvic fin length	17.10 (0.56)	16.36–17.74	16.90 (0.69)	16.00–17.44
Caudal peduncle length	19.50 (0.73)	18.74–20.68	20.70 (1.02)	19.92–22.13
Least depth of Caudal peduncle	12.30 (0.18)	12.09–12.57	13.60 (0.36)	13.22–13.96
Pre pelvic distance	49.90 (1.90)	47.35–52.49	49.40 (0.71)	48.77–50.38
Pre anal distance	71.10 (2.40)	68.96–74.94	70.80 (1.76)	68.59–72.49
Anal fin base length	9.20 (0.42)	8.70–9.74	8.40 (0.21)	8.20–8.68
Anal fin length	18.70 (1.13)	17.46–19.88	18.10 (0.80)	17.59–19.29
% HL				
Head depth	65.43 (3.78)	61.08–70.11	69.20 (2.44)	67.61–72.83
Head width	57.76 (3.47)	55.08–63.66	54.65 (3.43)	51.37–58.28
Eye diameter	29.50 (2.26)	27.81–33.29	31.83 (0.79)	30.65–32.29
Snout length	21.67 (0.70)	20.85–22.69	24.05 (1.61)	21.65–25.00
Inter orbital width	36.94 (2.59)	34.53–40.06	35.16 (1.29)	33.86–36.74
Meristic counts				
Lateral line scales (LL)		24–25		23–25
Scales between LL and dorsal fin base		3½		3½–4
Scales between LL and anal fin base		2½		2½
Predorsal scales		8–10		8–9
Prepelvic scales		6–7		6–7
Preanal scales		12–14		13–15
Dorsal fin rays		ii+7		ii+7
Pectoral fin rays		i+10–11		i+10–11
Pelvic fin rays		ii+7–8		ii+7–8
Anal fin rays		ii+5		ii+5
Caudal fin procurrent rays		12–14		12–16
Caudal fin principal rays		19		19

Live colour. Dorsal and lateral aspects olive-green and abdomen silvery. A prominent black spot near flexure line of caudal fin, and another on dorsal fin base (Fig. 1). Scale margins brown. Adults show a crimson band on lateral side during the breeding season.

Discussion

Puntius populations in peninsular India, which were assigned to *P. bimaculatus*, show differences from those in Sri Lanka, where *P. bimaculatus* sensu stricto was described. *Puntius* from Bangalore, India, showing 2 spots on the body were initially described as *P. puckelli* by Day (1868), which was tentatively treated as a synonym of *P. bimaculatus* sensu lato (Menon and Devi 1992). *Puntius bimaculatus* sensu stricto from Sri Lanka have been reported to have 3 unbranched and 7 branched rays in the dorsal fin (Günther 1868), while *P. bimaculatus* sensu lato from peninsular India has been reported to have 1 unbranched and 7 branched rays (Jayaram 1991). Our specimens exhibit differences from those reported earlier (Günther 1868, Jayaram 1991). They are smaller both with respect to head length (HL: 28.21–36.36 mm vs 25.42–27.76 mm) and body depth (BD: 26.78–30.68 mm vs 24.61–28.63 mm). Interestingly, the specimens from the Pennar river basin have slightly larger body depth than those from the Krishna river basin (BD: 25.92–28.63 mm vs 24.61–26.47 mm). Our specimens also

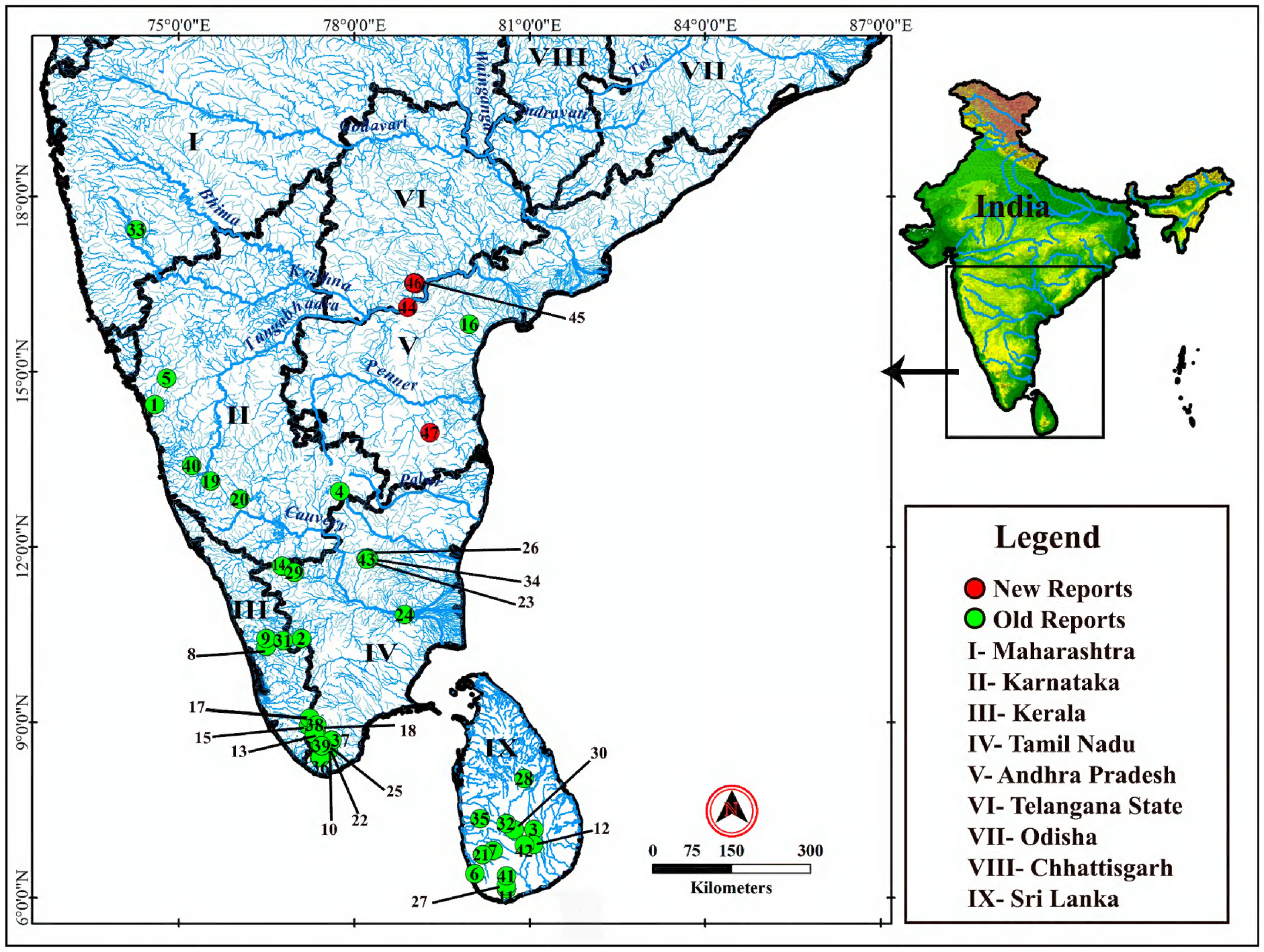

Figure 2. Distribution of the *Puntius bimaculatus*, numerical numbers with green circle show earlier reports in India and Sri Lanka. Numerical numbers with red circles show new locality reports from Andhra Pradesh and Telangana state, India. Numerical numbers in the map represent serial numbers in the Table 2.

varied from the other Indian populations (see Jayaram 1991) in possessing 2 unbranched and 7 branched rays (vs 1 unbranched and 7 branched rays) in dorsal fin; 2 unbranched and 7 or 8 branched rays (vs 1 unbranched and 8 branched rays) in pelvic fin; and 12 circumpeduncular scales (vs 10 or 11 scales).

The new sites reported by us extends the distribution of the *P. bimaculatus* further north into the Eastern Ghats and constitutes the second report of this species in the Krishna river basin and the first report from Pennar river basin in the eastern peninsular India. This species has been reported from many localities in the Western Ghats from Phansad, Maharashtra (Arunachalam 2000) in north to Samikutchi Falls, Chittar River, Tamil Nadu in south (Fig. 2, Table 2). It has a discontinuous distribution in the Eastern Ghats, with the northernmost distribution reported from Gundlakamma River, Andhra Pradesh (Sharma and Nayak 2006). The detection of *P. bimaculatus* from 2 new sites is indicative of the Wallacean shortfall, which could generally be applicable to most species of hill stream fishes. *Puntius bimaculatus* could be more widespread than currently known. Although this species has value in the aquarium trade, its presence in the Eastern Ghats has not been well studied. Unexplored areas should be searched and taxonomic and ecological studies are necessary.

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Authors' Contributions

KP conducted the field study, identified the species, prepared the map and the first draft of the manuscript. CS supervised the research and prepared the final version of the manuscript.

Table 2. Localities from where *Puntius bimaculatus* were reported from India and Sri Lanka.

No.	Location	Latitude	Longitude	Source
1	Aghanashini, Karnataka, India	14°26.063′N	074°35.141′E	Bhat 2000
2	Anamalai Tiger Reserve, Tamil Nadu, India	10°25.898′N	077°05.767′E	Devi et al. 2005
3	Arawa, Sri Lanka	07°09.743′N	081°03.884′E	De Silva and Liyanage 2009
4	Bangalore, Karnataka, India	12°57.140′N	077°45.081′E	Jayaram et al. 1982
5	Bedti, Karnataka, India	14°53.356′N	074°47.111′E	Bhat 2000
6	Bentota, Sri Lanka	06°24.518′N	080°03.486′E	Pethiyagoda et al. 2012
7	Bopath Ella, Sri Lanka	06°48.147′N	080°22.225′E	De Silva and Liyanage 2009
8	Chalakudy River, Kerala, India	10°17.625′N	076°29.276′E	Raghavan et al. 2008
9	Chimminy Wild life Sanctuary, Kerala State, India	10°25.943′N	076°29.277′E	Gopi 2000
10	Chittar, Tamil Nadu, India	08°23.828′N	077°24.633′E	Arunachalam et al. 2000a, Arunachalam et al. 2000b
11	Deiyandara, Sri Lanka	06°08.982′N	080°35.968′E	De Silva and Liyanage 2009
12	Demodara, Sri Lanka	06°54.364′N	081°03.614′E	De Silva and Liyanage 2009
13	Gadana River, Tamil Nadu, India	08°47.005′N	077°21.367′E	Arunachalam 2000, Arunachalam et al. 2000b
14	Gugalthurai, Cauveri River East flowing, Tamil Nadu, India	11°40.466′N	076°45.566′E	Johnson and Arunachalam 2009
15	Gundar, Tami Nadu, India	08°56.684′N	077°12.768′E	Arunachalam 2000
16	Gundlakamma River, Andhra Pradesh, India	15°48.638′N	079°57.650′E	Sharma and Nayak 2006
17	Hanuman Nathi, Tami Nadu, India	09°04.071′N	077°13.941′E	Arunachalam 2000
18	Hanumannadhi, Chittar River East flowing, Tami Nadu, India	08°57.145′N	077°21.072′E	Johnson and Arunachalam 2009
19	Hemavathi River at Kottigehar, Karnataka, India	13°07.582′N	075°32.219′E	Jayaram 1991
20	Hemavathi River, Karnataka, India	12°49.333′N	076°02.243′E	Arunachalam et al. 2000b
21	Ingiriya, Sri Lanka	06°44.116′N	080°11.365′E	De Silva and Liyanage 2009
22	Kakalakad, Tami Nadu, India	08°30.661′N	077°33.220′E	Menon and Devi 1992, Jayaram 1991, Gopi 2000
23	Kiliyur Falls, Yercaud, Salem District, Tamil Nadu	11°47.774′N	078°12.076′E	Ramanujam 2015
24	Kollidam River (Coleroon River), Tamil Nadu, India	10°50.458′N	078°51.275′E	Jayaram et al. 1982
25	Manimuthar, Tamil Nadu, India	08°37.173′N	077°24.731′E	Arunachalam et al. 2000b
26	Manjakuttai, Salem District Tamil Nadu	11°48.565′N	078°13.362′E	Ramanujam 2015
27	Mawarala, Sri Lanka	06°12.073′N	080°35.571′E	De Silva and Liyanage 2009
28	Minneriya, Sri Lanka	08°02.234′N	080°53.922′E	Pethiyagoda et al. 2012
29	Moyar River, Tamil Nadu, India	11°33.897′N	076°58.221′E	Arunachalam et al. 2000b
30	Pallegama, Sri Lanka	07°09.640′N	080°43.720′E	De Silva and Liyanage 2009
31	Parmambikulam wildlife sanctuary, Kerala state, India	10°23.988′N	076°46.895′E	Gopi 2000
32	Peradeniya, Sri Lanka	07°15.924′N	080°35.610′E	Jayaram 1991
33	Phansad, Maharashtra, India	17°25.398′N	074°16.168′E	Arunachalam 2000
34	Puthur, Salem District, Tamil Nadu	11°47.617′N	078°14.338′E	Ramanujam 2015
35	Rampadeniya, Sri Lanka	07°20.992′N	080°08.980′E	De Silva and Liyanage 2009
36	Samikutchi Falls, Chittar river, West flowing, Tamil Nadu, India	08°23.846′N	077°24.638′E	Arunachalam et al. 2000b, Johnson and Arunachalam 2009
37	Tahalaianai, Tamil Nadu, India	08°47.802′N	077°18.924′E	Arunachalam 2000
38	Tamiraparani river, Tami Nadu, India	08°41.405′N	077°36.702′E	Menon and Devi 1992
39	Thalayanai, Manimuthar River	08°35.741′N	077°26.082′E	Johnson and Arunachalam 2009
40	Thunga River, Karnataka, India	13°23.407′N	075°12.981′E	Arunachalam et al. 2000b
41	Viharahena, Sri Lanka	06°22.174′N	080°35.799′E	De Silva and Liyanage 2009
42	Welimada, Sri Lanka	06°53.942′N	080°54.328′E	De Silva and Liyanage 2009
43	Yercaud Lake, Yercaud Salem district, Tamil Nadu	11°47.089′N	078°12.576′E	Ramanujam 2015
44	Pathalaganga, Nagarkurnool district, Telangana state, India	16°05.849′N	078°54.450′E	Present study
45	A stream near Devaracharla, Chitriyal, Nalgonda district, Telangana state, India	16°30.525′N	079°02.342′E	Present study
46	A stream near Rekulagadda, Chitriyal, Nalgonda district, Telangana state, India	16°30.225′N	079°02.835′E	Present study
47	Yerraguntla Kota, Koduru, Kadapa district, Andhra Pradesh, India	13°57.166′N	079°17.337′E	Present study

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